§3. Construction of X-ray Pulse Height Analyzer Assemblies with Radial Scanning System in LHD

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The observation of x-ray is important for the fusion plasma research to measure the electron temperature and the amount of impurities. A pulse height analysis technique is planed to be applied to LHD plasma experiments for these primary interests mentioned above and also a measurement of non thermal electrons. In the plan will be performed x-ray observations with space resolution better than 10 mm in the radial direction. The estimation of the non thermal electrons of a part being heated by ECH is expected.

Two assemblies were designed and constructed for x-ray observations in LHD. One of them is to be installed on 2.5-L port of LHD. The other is to be installed on 2-O port.

Figure 1 shows the schematic view of the design of the assembly to be installed on 2.5-L port. The assembly is equipped with an evacuating system, 4 Si(Li) semiconductor x-ray detectors, an automatic liquid nitrogen transfer system, an x-ray filter exchanging system controlled by a computer, and a scanning system for the 4 detectors to perform x-ray measurements with space resolution to be better than 10 mm.

The detector comprises 4 pre-amplifiers, a portable cryostat, and 4 Si(Li) elements mounted inside a vacuum enclosure with a Be window (12.5 μ m thickness). Each of the 4 elements is arranged on the corners of a 13mm square. The diameter of the element is 8mm. The energy resolution (FWHM) of the element is better than 170eV and 260eV at 5.9keV with 8 μ sec shaping time and 1k counts per second and with 2 μ sec shaping time and 100k counts per second, respectively.

The scanning system for the space resolution measurements consists of an x-ray shield plate with 4 rectangular holes for the 4 detectors and linear motion system which flips the plate. The stroke of the plate is 400 mm and the maximum speed of the plate is 400 mm/sec. The interval of scans in succession is about 0.5 second.

The assembly for 2-O port is equipped with an evacuating system, a Si(Li) semiconductor x-ray detector, a Ge semiconductor x-ray detector, an automatic liquid nitrogen transfer system, an x-ray filter exchange system controlled by a computer.

The Ge detector comprises 4 pre-amplifiers, a portable cryostat, and 4 Ge elements mounted inside a vacuum enclosure with a Be window (12.5 μ m sickness). The diameter of the element is 8mm. The energy resolution (FWHM) of the element is better than 165eV and 300eV at 5.9keV with 6 μ sec shaping time and 1k counts per second and with 1 μ sec shaping time and 100k counts per second, respectively. The energy resolution at 122keV is better than 495eV with 6 μ sec shaping time and 1k counts per second.

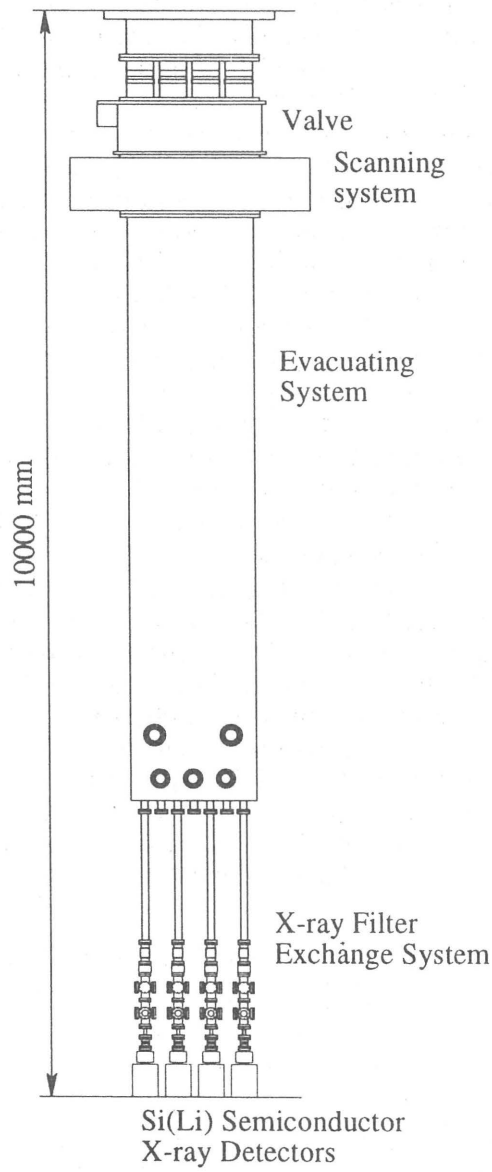

Fig. 1. Schematic view of the design of the assembly to be installed on 2.5-L port.